S I R G E O R G E W I L L I A M S U N I V E R S I T Y

February 1971

MASTER OF ENGINEERING
through
EVENING STUDIES

GENERAL INFORMATION

The Faculty of Engineering offers a programme leading to the Degree of Master of Engineering, through Evening Studies. It is designed to meet the continuing educational needs of practising Engineers, in a formal setting. There is no full-time residence requirement; the degree requirements may be satisfied by a combination of course work and dissertation, with a balance between courses and dissertation which may be varied according to the needs of each particular student.

The programme, while leading to a Faculty Degree rather than a Departmental Degree, provides an opportunity for a student to follow an integrated series of courses in his particular field of interest.

ADMISSION REQUIREMENTS

Applicants must hold a Bachelor's Degree in Engineering, or equivalent qualification, with high standing, and must be currently employed in Engineering.

The Engineering Graduate Studies Committee will determine the acceptability of an applicant for admission to the programme for the degree of Master of Engineering (M.Eng.), and may require an applicant to take specified undergraduate courses in order to qualify for acceptance.

APPLICATION FOR ADMISSION

An applicant for admission to this Programme is required:

(a) To complete an official application form, and submit it with a non-refundable application fee of ten dollars;

(b) To forward an official transcript of the record of previous studies;

(c) To arrange for two letters of recommendation from persons familiar with the applicant's work.

All documents should be sent directly to:

The Secretary for Engineering Graduate Studies,
Faculty of Engineering,
Sir George Williams University,
MONTREAL 107, Quebec.

Admission is not complete until all the necessary documents have been submitted, the application fee has been paid, and the application has been approved.

REQUIREMENTS FOR THE DEGREE

1. A fully qualified applicant is required to complete successfully course work and a dissertation requirement for a total of 14 half-credits, and to demonstrate his ability to translate engineering literature from French into English (with the aid of a dictionary) in order to fulfil the requirement for the Degree of Master of Engineering. A half-course is evaluated as a half-credit, and the student can elect to take from eight to twelve half-courses. The dissertation is evaluated as shown following Course Descriptions, and it can vary from a full research thesis to a major technical report. The student will decide on the particular balance between course work and dissertation, in consultation with faculty, and will plan an individual programme of study. Each individual programme of study must be approved by the

Engineering Graduate Studies Committee. When a student has chosen a suitable dissertation topic and has arranged for faculty supervision, his dissertation supervisor will be formally appointed by the Engineering Graduate Studies Committee.

2. The dissertation must represent the results of the student's independent work undertaken after admission to this programme. Work previously published by the student may be used only as introduction or background subject matter. The proposed topic for the dissertation, together with a brief statement outlining the proposed method of treatment, must be approved by the Engineering Graduate Studies Committee. The dissertation will be evaluated by at least two examiners appointed by the Engineering Graduate Studies Committee.

3. Prior to the conferment of the degree, the student must satisfy the Engineering Graduate Studies Committee in respect to his ability to translate engineering literature from French into English. A special examination, in which the use of a dictionary is permitted, may be set.

4. Through the cooperation of the Faculty of Engineering of McGill University, a student may include in his programme

some course work from among the current graduate offerings at McGill University, provided that approval for such course work is obtained from the student's advisor prior to registration at McGill University.

5. A student may be granted *pro tanto* credit for, in general, the equivalent of not more than one full course taken in approved graduate studies prior to entry into this programme. A course submitted for *pro tanto* credit must be appropriate to the student's programme of study at Sir George Williams University. An application for such credit will be considered only at the time of initial registration. (This paragraph does not apply to graduate courses taken at McGill University under the provisions of paragraph 4 above.)

SUMMER SESSION 1971

The following courses in the Master of Engineering Programme will be offered. Classrooms will be allocated later. It is hoped to offer all courses in the time period 6:15 p.m. to 8:10 p.m. on TUESDAYS and THURSDAYS.

PERIOD I

Tuesdays & Thursdays, commencing 27 April & ending 15 June 1971

Engin 601	Engineering Analysis I
Engin 762	Computer Software I
Civil Eng 713	Stiffened Plates and Shells
Elect Eng 701	Lumped Network Analysis
Elect Eng 721	Electronic Conduction in Solids
Mech Eng 703	Boundary Layer Theory

PERIOD II

Tuesdays & Thursdays, 22 to 29 June; 6 to 8 July; 3 August to 1 September 1971

Engin 610	Physical Systems
Engin 741	Fluidic Elements and Systems
Civil Eng 721	Systems Building
Elect Eng 711	Passive Network Synthesis
Mech Eng 761	Mechanics of Metal Machining and Surface Geometry

COURSES AND TOPICS IN RESEARCH AREAS

All of the courses listed are half-courses (half-credits). Courses marked with an asterisk are offered in 1971-72. Summer courses will be offered in the summer of 1971.

901. Engineering 601.* Engineering Analysis 1

Theory and application of topics in mathematics. Topics include: Matrix and Vector Analysis, Functions of a complex variable, Ordinary differential equations. (Summer only).

901. Engineering 602.* Numerical Methods in Engineering Systems 1

Methods of numerical solution of mathematical models in Engineering. Interpolation. Quadratures for numerical differentiation and integration of tabulated functions. Zeros of polynomials. Systems of linear and non-linear algebraic equations. Numerical solutions of ordinary differential equations using single and multi-step methods. Analysis of round-off and discretization errors. Numerical techniques for the inversion of matrices, and for determining eigenvalues and eigenvectors of matrices, state vectors and transfer vectors and matrices. (Fall term).

901. Engineering 610.* Physical Systems

A study of modelling and analysis of physical systems with emphasis on similarities of systems in various media. Dynamic system elements. Generalized dynamic elements. Formulation of system equations and transfer functions using matrices. Signal flow graph theory. Analog simulation. Transient and steady state solutions. Frequency response analysis. Stability studies. (Summer only).

901. Engineering 611.* Stochastic Processes in Systems

Probability and random variables, stochastic processes. Correlation functions and power spectra of stationary stochastic processes, filtering, smoothing and prediction. (Fall term).

901. Engineering 620.* Analog and Hybrid Simulation

Analog and hybrid computer fundamentals; programming of differential equations on analog computers; scaling techniques; generation of explicit and implicit functions; error analysis; logic circuits and their application in analog computing; analog/hybrid computer. (Fall term).

901. Engineering 630.* Advanced Dynamics

Dynamics of rigid bodies, D'Alembert's principle, generalized coordinates, energy methods, Hamilton's theory, the Euler-lagrange equations,variational principle of mechanics, Lagrangian multiplier method, Jacobi's principle, the phase space canonical transformations, Hamilton-Jacobi equations, theory of gyroscopes. (Fall term).

901. Engineering 640.* Advanced Fluid Mechanics

Fundamental concepts of fluid mechanics, transport phenomena, stress-strain relations, equations of motion, exact solutions, dynamic similarity, specialized equations, laminar boundary layers, flow over immersed bodies, introduction to turbulent flow. (Fall term).

901. Engineering 650. Applied Elasticity

Plane stress and strain. Analysis of stress and strain in three dimensions. Airy's stress function. Solution of two-dimensional problems by polynomials and Fourier series. Effect of small holes in bars and plates. Torsion and bending of prismatical bars. Membrane analogy. Thermoelasticity. Rectangular, circular, ring-shaped flat plates. Applications in civil and mechanical engineering.

901. Engineering 651. Matrix Analysis of Structures

Analysis of statically loaded framed structures by matrix methods; energy concepts in matrix form; transformation of information in structures; flexibility and stiffness methods; computer applications.

901. Engineering 660. Computer Organization

Component parts, organization and relation to programming, of a modern digital computer. Topics include: logic devices; word and byte structures; serial and parallel processing; data structures and effect on hardware construction; parity and operation checking; memory and storage units; registers; peripheral equipment; interrupts; real-time hardware; communications hardware; multiplexing; machine language and assembler programming.

901. Engineering 701.* Engineering Analysis II

Advanced topics in methematics. Topics include: Sturm-Liouville problem, orthogonal functions, partial differential equations, boundary value problems, integral transforms. Introduction to the calculus of variations. Tensor analysis.

Prerequisite: E601 or equivalent. (Winter term).

901. Engineering 702.* Numerical Methods in Engineering Systems II

Finite difference forms for elliptic, parabolic and hyperbolic partial differential equations. Minimization techniques for linear and non-linear systems, with applications to closed loop systems. Curve fitting and Fourier synthesis.

Prerequisite: E602 or equivalent.

901. ENGINEERING 710. TOPICS IN SYSTEMS THEORY

Topics offered include: sample-data systems; linear systems; nonlinear systems; optimal control; estimation and stochastic control.

901. Engineering 712.* Linear Systems

Types of linear systems: continuous-time vs. discrete, constant vs. varying, etc.; state variable representation of systems; solution of linear differential and difference equations; controllability, observability, and adjoint systems; zero input stability and the Liapunov equation; input-output stability and the Nyquist and circle criteria.

Prerequisite: E610 or equivalent. (Fall term).

901. Engineering 713.* Nonlinear Systems

Phase plane analysis of second order systems; well-known nonlinear equations such as Van der Pol's equation, Mathieu's equation; equivalent gain and describing functions; Volterra series analysis of systems; Liapunov stability and quantitative stability.

Prerequisite: E610 or equivalent. (Winter term).

901. Engineering 715.* Optimal Control

Calculus of variations; the maximum principle for continuous and discrete systems; linear and convex programming; dynamic programming; distributed systems.

Prerequisite: E712 or equivalent. (Fall term).

901. Engineering 716.* Estimation and Stochastic Control

Development of system model; optimal prediction, filtering and smoothing for discrete and continuous linear systems; extension to nonlinear systems; stochastic optimal control for discrete and continuous systems; bayesian approach.

Prerequisite: E611 and E712 or equivalents. (Winter term).

901. ENGINEERING 720. TOPICS IN SYSTEMS SIMULATION

Topics offered include: Hybrid computer programming; advanced simulation techniques.

901. Engineering 722.* Advanced Simulation Techniques

Hybrid computers involving a stored programme digital computer; hybrid software; iterative computation; adaptive and optimization techniques, random process simulation; the use of statistical methods.

Prerequisite: E620 or equivalent. (Winter term).

901. ENGINEERING 740. TOPICS IN FLUID CONTROL ELEMENTS AND SYSTEMS

These studies deal with special topics in fluid control elements and systems such as pneumatic and hydraulic controls, fluidic devices and systems, and hydraulic power systems where fluid motion and displacement contain and transmit information as well as power. Topics offered include: fluidic elements and systems; process control systems design; industrial process control and computer applications; design of fluid control elements and systems.

901. Engineering 741.* Fluidic Elements and Systems

Principles and operating characteristics of fluidic elements, modelling of wall attachment, beam-deflection, turbulent and vortex amplifiers, design and analysis of microdiaphragm and diaphragm ejector amplifiers, methods of evaluating performance characteristics of fluid devices, passive fluidic elements, digital and analog fluidic circuit theories and their applications; case studies of fluidic systems.

Prerequisite: E640 or equivalent. (Summer only).

901. Engineering 742.* Design of Process Control Systems

Regulation theory, conventional design techniques, cascade and feed-forward control, controller and final control element characteristics, modal control applications to flow, pressure, level, heat transfer or mass transfer processes.

Prerequisite: E610 or equivalent. (Winter term).

901. Engineering 744.* Design of Fluid Control Elements and Systems

Design studies of no-moving-part, hybrid, micro-diaphragm and vortex devices. System design studies include applications in medicine, engine control systems and digital and analog systems in industrial controls. Special concepts in the development of sensors.

Prerequisite: E640 or equivalent. (Fall term).

901. ENGINEERING 750. TOPICS IN SOLID MECHANICS

Topics offered include: theory of elastic and inelastic stability; experimental stress analysis; the finite element method in structural mechanics; mechanics of composite structures.

901. Engineering 751.* Theory of Elastic and Inelastic Stability

Analysis of elastic and inelastic stability of columns, frame buckling, beam-columns, strength of plates, shear webs, and shells, torsional-flexural buckling of thin-walled, open sections, snap-through, critical discussion of current design specifications, applications to civil and aeronautical structures.

Prerequisite: Graduate course in Structural Engineering.

(Winter term)

901. Engineering 752. Experimental Stress Analysis

Photoelasticity: two-dimensional stress fields, models, types of polariscopes, the shear difference method, three-dimensional stress fields, relaxation solution, oblique incidence, isotropic points; frozen patterns, scattered light analysis; photoelastic coating; photoelastic strain gages. Electrical Strain Gages: gage construction; temperature compensation; gage selection; gage sensitivities and gage factor; adhesives; strain cycling, effects due to moisture, humidity, time and direct loading; multi-element rosettes; strain-gage circuits and instrumentation. Moiré Fringes, brittle lacquer, models and analogs. Mechanical and optical strain gages.

Prerequisite: E650 or equivalent.

901. Engineering 753. The Finite Element Method in Structural Mechanics

Displacement analysis of structures. Finite elements of a continuum. Applications of the method of stress analysis of two - and three - dimensional structures, stability problems, vibrations and heat transfer. Digital computer applications.

Prerequisite: E651 or equivalent.

901. Engineering 754.* Mechanics of Composite Structures

Multi-layered beams, beam columns, plates and shells, bending and buckling of orthotropic sandwich panels with thin faces, alternative solution based on differential equations of sandwich panel, wrinkling and other forms of local instability, the development of the theory of sandwich panels.

Prerequisite: E650 or equivalent. (Winter term)

901. ENGINEERING 760. TOPICS IN COMPUTER SCIENCE

Topics offered include: computer operating systems; computer software I; computer Software II; computer aided design and operations research.

901. Engineering 761. Computer Operating Systems

Component parts of a complete operating system; effect on computer operation. Topics include: general principles of an operating system; batch operating systems; executive programme; input and output control systems; time sharing and multi-programming; scheduling considerations; programme linkages and subroutine; library structures; file manipulation; real-time and communication considerations; future developments.

Prerequisite: E660 or equivalent.

901. Engineering 762.* Computer Software I

Selected problem and application languages; their structure and characteristics; linked lists; file organization techniques; data searching; keys; qualifiers; posting; updating; sharing.

Prerequisite: E660 or equivalent. (Summer only)

901. Engineering 763.* Computer Software II

A study of theory and practice in the data structures; algorithms of information structuring; directory and data file design; data base implementation; data management systems.

Prerequisite: E762 or equivalent. (Fall term)

901. Engineering 764.* Computer Aided Design and Operations Research

Interactive systems; problem-oriented languages; data structures; modeling; simulation and control of engineering problems.

Prerequisite: E762 or equivalent. (Winter term)

903. Civil Engineering 600.* Reinforced Concrete

Analysis and design by ultimate strength methods of beams, columns, slabs, continuous frames, composite and prestressed concrete members; arch and shell roofs; concrete building systems; new ACI and NBC codes; computer applications; design manuals; yield-line analysis of slabs. (Fall term).

903. CIVIL ENGINEERING 700. TOPICS IN STRUCTURAL ENGINEERING.

Topics offered include: structural synthesis; structural dynamics; failure of metal assemblies; strength of structures; suspended and stiffened cable structures, substructural analysis and design; foundation design; prestressed concrete; hydroelasticity.

903. Civil Engineering 701. Structural Synthesis

Structures of minimum material consumption. Theory of Maxwell-Michell structures. Automated optimum design of structural systems. Applications of mathematical programming techniques to systematic optimum design of structures under various constraints such as stress, deflection, buckling, reliability and costs.

Prerequisite: E651 or equivalent.

903. Civil Engineering 703. Failure of Metal Assemblies

The many possible reasons for the failure of a metal structure to perform its function are examined, including elastic deformations, yielding, buckling, fatigue, creep, brittle fracture, with comparison of elastic design and limit design, and concepts of safety and optimization.

Prerequisite: E651 or equivalent.

903. CIVIL ENGINEERING 710. TOPICS IN PLATES AND SHELLS

Topics offered include: Theory of plates and shells; multi-layered plates and shells; stiffened plates and shells.

903. Civil Engineering 713.* Stiffened Plates and Shells

Comparison of simplified theories for folded plates; continuous folded plates; multiple plates meeting at one joint; nonlinear solution; folded plates and industrialized building; theory and design of stiffened thin-plate elements; orthotropic plates and shells; fiber reinforced shells.

Prerequisite: E650 or equivalent. (Summer only).

903. CIVIL ENGINEERING 720. TOPICS IN BUILDING SYSTEMS

Topics offered include: System building; industrialized buildings; modern steel buildings; modern concrete buildings; reliability analysis.

903. Civil Engineering 721.* System Building

Systems approach to planning, organization, and implementation of a project, from initiation of the concept to the administration of the occupied building, including architecture, engineering, construction and socio-economic considerations. The industrialization of the building as a product, including structure, weather screen, and all essential fittings and equipment.

Prerequisite: E651 or equivalent. (Summer only).

903. Civil Engineering 722.* Panelized Building

Use of prefabricates in the construction of buildings; principles of prefabricated building design, general design assumptions and structural requirements, three-dimensional stiffness of buildings; floors, stairs, roofs and walls; problems of thermal and acoustic insulation and of fire protection; analysis and design of panelized building systems, experimental results.

Prerequisite: CE721 or equivalent. (Fall term).

903. CIVIL ENGINEERING 730. TOPICS IN BRIDGE ENGINEERING

Topics offered include: theory and design of modern bridge systems; theory and design of orthotropic bridges; theory and design of cable-stayed bridges.

903. Civil Engineering 731. Theory and Design of Modern Bridge Systems

Hybrid, post-stressed and composite plate girders and trusses. Delta type girders. Orthotropic, shell type and tubular bridges. Cable-stayed and stiffened cable bridges. Optimization of bridge systems. Vibrations and damping capacity. Aerodynamical and seismic stability. Concept of safety. Fatigue and carrying capacity. Use of models. Application of computers.

Prerequisite: E651 or equivalent.

903. Civil Engineering 732.* Theory and Design of Orthotropic Bridges

Natural and technical orthotropy, orthogonally stiffened plates, methods of bridge analysis and design, materials, specifications, analysis of existing orthotropic structures, numerical examples.

Prerequisite: E651 or equivalent. (Fall term).

903. CIVIL ENGINEERING 740. TOPICS IN TRANSPORTATION ENGINEERING

Topics offered include: traffic studies and characteristics; traffic regulation and operation; urban planning; urban transportation and system planning; urban transportation system analysis; highway planning and economics; advanced geometric design of highways.

903. Civil Engineering 744.* Urban Transportation System Planning

The urban transportation problem; urban travel characteristics; urban transportation planning studies; land use and trip generation; trip distribution and trip assignment, model split.

Prerequisite: Graduate Course in Transportation or equivalent. (Fall term)

903. Civil Engineering 745.* Urban Transportation System Analysis

Application of mathematical models and the electronic computer to the analysis and evaluation of urban transportation problems. Multiple use and design team concepts. Urban planning and transportation. Transportation administration.

Prerequisite: Graduate Course in Transportation or equivalent. (Winter term).

903. CIVIL ENGINEERING 760. TOPICS IN WATER RESOURCES

Topics offered include: Engineering hydrology; advanced hydrology; open channel hydraulics I; advanced hydraulic engineering; water resources System I; hydrodynamics, statistical hydrology; open channel flow II, Water resources systems II.

903. Civil Engineering 761.* Engineering Hydrology

Weather elements, descriptive hydrology, quantitative hydrology, ground water, probability concepts, reservoirs, application of hydrologic techniques.

Prerequisite: Graduate courses in Water Resources or equivalent. (Fall term).

903. Civil Engineering 762. Advanced Hydrology

Linear and non-linear hydrology systems; small watersheds; design factors related to urban areas; sediment transport; Stochastic models in hydrology and their analysis; analogue and digital filtering of storm data records.

Prerequisite: Graduate Course in Water Resources or equivalent.

903. Civil Engineering 763.* Open Channel Hydraulics I

Classification of open channel flows, energy coefficient, specific energy, non-prismatic channels, hydraulic exponent, uniform flow, Manning equation, design examples, conveyance, composite roughness, limit slope, overland flow, design of non-erodible channels, stable hydraulic section, retardance coefficient, gradually varied flow, analysis of flow profile, methods of computations, practical problems.

Prerequisite: Graduate courses in Water Resources or equivalent. (Fall term - if CE761 is not offered)

903. Civil Engineering 764.* Advanced Hydraulic Engineering

Design in engineering, optimisation, basic measurements in hydraulic engineering, storage reservoirs, practical problems, run-off characteristics of natural streams, control structures, economic analysis, energy dissipators, sediment transportation, transitions, elements of river engineering, navigation, control of floods, selection of hydraulic machines.

Prerequisite: CE763 or equivalent. (Winter term)

903. Civil Engineering 765.* Water Resources Systems I

System concept, economic and technological factors affecting system design, graphic techniques, production function, multi-unit, multi-purpose systems, a simplified river basin system, simulation techniques, programming and examination of a response surface.

Prerequisite: CE761 or equivalent. (Winter term - if CE764 is not offered)

903. CIVIL ENGINEERING 800. MODERN DEVELOPMENTS IN STRUCTURES

Current topics selected from theories of structures; plates and shells; building systems; bridge systems.

903. Civil Engineering 803.* Current Topics in Building Systems

Seminars on modern developments in building systems.

Prerequisite: A topic in CE700 or equivalent. (Winter term)

905. Electrical Engineering 600. Statistical Theory of Communication

Mathematical representation of random signals, transmission and filtering of random signals, mean square optimum filters, matched filters, noise analysis of communication systems, decision theory, elementary informative theory, digital data communication.

905. Electrical Engineering 660.* Electrodynamics

Maxwell's equations in free space. Fields and matter. Electromagnetic energy and power. Sinusoidal steady state. Electromagnetic fields in moving media. Forces and energy in moving systems. (Fall term).

905. ELECTRICAL ENGINEERING 700. TOPICS IN NETWORK ANALYSIS

Topics offered include: lumped network analysis; linear graphs and electric networks; digital filters.

905. Electrical Engineering 701.* Lumped Network Analysis

Formulation of impedance and admittance matrices and their properties. Indefinite admittance matrix and its applications. General two-ports: passivity, reciprocity and stability. The state variable analysis of networks.

Prerequisite: E610 or equivalent. (Summer only).

905. Electrical Engineering 702. Linear Graphs and Electrical Networks

Basic properties of graphs. Vector spaces associated with a graph, non-directed and directed graphs. Topological formulas. Applications to network analysis, synthesis and switching theory. Flow graphs and other applications of graph theory.

Prerequisite: E610 or equivalent.

905. Electrical Engineering 703.* Digital Filters

Introduction to recursive and non-recursive digital filters; realization methods using the z-transform calculus; amplitude and phase characteristics and relevant approximations and transformations; comparison of digital with conventional filters; application of digital filters.

Prerequisite: EE701 or equivalent. (Fall term).

905. ELECTRICAL ENGINEERING 710. TOPICS IN NETWORK SYNTHESIS

Topics offered include: passive network synthesis; active network synthesis; distributed parameter network synthesis.

905. Electrical Engineering 711.* Passive Network Synthesis

Positive real functions; RLC driving point function synthesis; Cascade synthesis of one-port networks; Realization of lossless one-port networks; Insertion loss synthesis; Realization of RC two-ports; General passive two-ports; Approximation in frequency and time domains.

Prerequisite: EE701 or equivalent. (Summer only)

905. Electrical Engineering 712.* Active Network Synthesis

Limitations of passive network synthesis. Active network elements and their uses in the synthesis of network functions. Polynomial decompositions and their applications. Sensitivity, selectivity and related topics.

Prerequisite: EE711 or equivalent. (Winter term).

905. Electrical Engineering 713. Distributed Parameter Network Synthesis

Properties of distributed parameter structures, including both uniformly and nonuniformly tapered lines. Basic nonuniform transmission lines. RC transmission lines. Synthesis of network functions using transmission lines. Introduction to multivariable synthesis. The approximation problem.

Prerequisite: EE711 or equivalent.

905. ELECTRICAL ENGINEERING 720. TOPICS IN MICROELECTRONICS

Topics offered include: electronic conduction in solids; microwave semiconductor devices; materials technology; device technology; solid state device design.

905. Electrical Engineeering 721.* Electronic Conduction in Solids

Dielectric properties; ferroelectric crystals. Diamagnetism and paramagnetism; lattice vibrations; transport equation; relaxation mechanisms; conductivity in metals; homogeneous semiconductors; optical properties of semiconductors; properties of semiconductors and metals in strong magnetic fields.

Prerequisite: Courses in Solid state physics and Electromagnetic field theory or equivalents. (Summer only)

905. Electrical Engineering 722. Microwave Semiconductor Devices

Principles and functions of microwave semiconductor devices, Varactor diodes and applications, Microwave solid state switches, limiters and phase shifters. Schottky-barrier devices. Detector and mixer diodes and circuits. Tunnel diodes and circuits. Avalanche transit-time diodes. Bulk-effect devices.

Prerequisite: EE660 or equivalent.

905. Electrical Engineering 723.* Materials Technology

Semiconductor chemistry; crystal growths; zone refining; solubility and distribution of impurities; deposition techniques, epitaxial growth; photolitography.

Prerequisite; EE660 or equivalent. (Winter term)

905. Electrical Engineering 724. Device Technology.

Technology of rectifiers, transistors, Metal semiconductor, metal insulator semiconductor, p-n-p-n and junction field effect devices. Optoelectronics. Linear and Digital integrated circuits. Limitations and advantages of microminiaturization.

Prerequisite: EE723 or equivalent.

905. Electrical Engineering 725.* Solid State Device Design

Active devices design and construction; thermal and mechanical design considerations; grown-junctions; alloy-junctions; diffused-junctions and surface-barrier devices; passive elements design and construction.

Prerequisite: EE724 or equivalent. (Fall term)

905. ELECTRICAL ENGINEERING 760. TOPICS IN HIGH FREQUENCY PHENOMENA

Topics offered include: wave propagation; microwave device analysis; fundamental concepts of lasers; laser spectroscopy and applications.

905. Electrical Engineering 761. Wave Propagation

Radiation from monochromatic sources in unbounded regions. Radiation from wire antennas. Multipole expansion of the radiated field. Transmission systems. Slow wave propagation. Coupled mode theory. Doppler effect in dispersive media. Propagation in anisotropic media.

Prerequisite: EE660 or equivalent.

905. Electrical Engineering 762.* Microwave Device Analysis

Circuit theory for waveguiding systems, impedance transformation and matching; resonant cavities; periodic structures and filters; ferrite devices; linear amplifiers; oscillators.

Prerequisite: EE660 or equivalent. (Winter term).

905. Electrical Engineering 763. Fundamental Concepts of Lasers

Basic theorems and postulates of quantum mechanics. Time independent Schrodinger equation. Matrix mechanics. Elementary quantum systems. Quantization of lattice vibration and of electromagnetic radiation. Polarization, diamagnetism and paramagnetism.

Prerequisite: EE660 or equivalent.

905. ELECTRICAL ENGINEERING 800. MODERN DEVELOPMENTS IN NETWORKS AND SYSTEMS

Current topics selected from : networks; systems.

905. Electrical Engineering 801. Modern Developments in Networks

Current topics in networks.

Prerequisite: EE712 and EE713 or equivalents. (Fall term)

905. Electrical Engineering 802. Modern Developments in Systems

Current topics in systems.

Prerequisite: E712 or equivalent. (Winter term).

908. Mechanical Engineering 600. Mechanics of Continuous Media

Mathematical preliminaries, review of cartesian tensors, stresses in a continuum, stress quadrics, deformation and flow, strain tensors, compatibility equations, finite strain, instantaneous motion, material rates of change, momentum and energy theorems, constitutive equations, perfect and viscous fluids, classical theory of elasticity, introduction to thermoelasticity and viscoelasticity.

908. Mechanical Engineering 601. Engineering Thermodynamics

Rigorous treatment of thermodynamic principles and their applications to reversible and irreversible processes with systems composed of pure substances and those involving external forces.

908. MECHANICAL ENGINEERING 700. TOPICS IN TRANSPORT PROCESSES

Topics offered include: turbulent flow; compressible fluid flow; boundary layer theory; gas dynamics; fluid machinery; conduction heat transfer; convection heat transfer; radiation; turbomachine fluid mechanics; mechanical analysis of gas turbines.

908. Mechanical Engineering 701. Turbulent Flow

Origin of turbulence, momentum and energy equations for turbulent flow, incompressible and compressible boundary layer flows, free turbulent flow, turbulent shear flow, advanced turbulence models, generalized computer programme for treating two-dimensional boundary layer flows.

Prerequisite: E640 or equivalent.

908. Mechanical Engineering 703.* Boundary Layer Theory

Introduction to cartesian tensors, fundamentals of continuum fluid mechanics, continuity and momentum equations, Navier-Stokes equation, exact solutions, energy equation, introduction to boundary layer theory, Blasius solution, similarity solutions, thermal boundary layers, examples, boundary layers with general pressure distributions, integral equations.

Prerequisite: E640 or ME600 or equivalent. (Summer only).

908. Mechanical Engineering 704.* Gas Dynamics

Combined effects in one-dimensional flow, multidimensional flow, method of characteristics, one-dimensional treatment of non-steady gas dynamics, shock wave interactions, instability phenomena of supersonic intake diffusers, shock-boundary layer interactions, flow of real gases, selected papers on combustion and detonation.

Prerequisite: E640 or equivalent. (Winter term).

908. Mechanical Engineering 705. Fluid Machinery

Cascade mechanics and boundary layers, thin airfoil theory, laws of three-dimensional fluid flow and two-dimensional solutions, radial equilibrium, theory of cavitation.

Prerequisite: E640 or equivalent.

908. Mechanical Engineering 706. Conduction Heat Transfer

Solutions by analytical, numerical, analogue and graphical methods to steady and transient temperature fields with and without heat sources, introduction to convection.

Prerequisite: E640 or equivalent.

908. Mechanical Engineering 707.* Convection Heat Transfer

Heat transfer in laminar flow: review of the differential and integral forms of the general energy equation for boundary layer regimes, solution of the energy equation for free convection, forced convection and heat transfer in entrance regions.

Heat transfer in turbulent flow: review of the energy equation for turbulent flow, momentum-heat transfer analogies, experimental results for forced convection, free convection, and combined free and forced convection.

Prerequisite: E640 or equivalent. (Fall term).

908. Mechanical Engineering 709.* Turbomachine Fluid Mechanics

General theory of two and three-dimensional flows, solution methods by Wu, Katsanis and Marsh for subsonic and supersonic flows, time dependent characteristic methods for transonic flows, shock wave, boundary layer and secondary flow problems, limitations of theoretical methods.

Prerequisite: E640 or equivalent. (Fall term).

908. MECHANICAL ENGINEERING 740. TOPICS IN VIBRATIONS

Topics offered include: methods and applications of vibration analysis; nonlinear oscillations; asymptotic methods; random vibrations; stability of vibratory systems.

908. Mechanical Engineering 741. Methods and Applications of Vibration Analysis

Undamped and damped free vibrations, vibrations under periodic and non-periodic forces, analysis of many degree of freedom systems and continuous systems, coupled oscillations, vibration measurements and introduction to non-linear and random oscillations.

Prerequisite: E630 or equivalent.

908. Mechanical Engineering 744.* Random Vibrations

Mathematical description of stochastic processes, spectral density and correlation functions, Gaussian and non-Gaussian random processes, Markov processes and Fokker-Planck equation, response of linear and nonlinear oscillatory systems to random excitation, nonstationary and narrow-band random processes.

Prerequisite: E630 or equivalent. (Winter term).

908. MECHANICAL ENGINEERING 760. TOPICS IN MECHANICS OF METAL CUTTING AND DESIGN OF MACHINE TOOLS

Topics offered include: mechanics of metal machining and surface geometry; theory and design of basic units and systems of machine tools; numerical and adaptive control of machine systems; vibration problems in machine systems and components; random processes in manufacturing systems.

908. Mechanical Engineering 761.* Mechanics of Metal Machining and Surface Geometry

Theoretical and practical aspects of mechanics and dynamics of metal machining, tool geometry in machine and working reference systems with their transformation matrices, machinability, wear, cutting forces, temperature distribution, tool material, unconventional machining, machining economics, optimizing techniques for cutting conditions, surface mechanics and application of random processes.

Prerequisite: E630 or equivalent. (Summer only).

908. Mechanical Engineering 762. Theory and Design of Machine Tools

Dynamics and self-induced vibrations in the metal cutting process, analysis and design of speed change gears, mechanical, electrical, and hydraulic drives, hydraulic copying systems and automatic control, numerical control of machine tools, machine tool vibrations, random processes in manufacturing systems.

Prerequisite: E630 or equivalent.

908. MECHANICAL ENGINEERING 770. TOPICS IN MATERIAL SCIENCE

Topics offered include: mechanical shaping and forming; powder metallurgy; casting; welding; fracture; high strength materials; ceramics; polymers; electrochemistry for engineers.

908. Mechanical Engineering 772. Powder Metallurgy

Manufacture and properties of powders. Pressing of powders; theory, die design, hydrostatic, rolling, extrusion, explosive, slip casting, sintering mechanisms and kinetics; volume diffusion, pores and grain boundaries, two component systems, activated sintering. Hot pressing, fritting, effect of wetting. Powder metallurgy products; special shapes with close tolerances, porous materials, bearings, immiscible metal combinations, metal-non-metal combinations; sintered carbides, cermets, ceramics.

Prerequisite: Graduate course in Material Science or equivalent.

908. Mechanical Engineering 773.* Casting

Phase equilibrium diagrams, mechanisms of solidification, design of castings for various molding processes, section sizes, dimensional accuracies and surface finishes, continuous casting, control of grain size, segregation and porosity.

Prerequisite: Graduate course in Material Science or equivalent. (Fall term).

908. Mechanical Engineering 775.* Fracture

Fracture mechanisms, ductile and cleavage. Brittle fracture, notch effects, propagation of cracks, ductile-brittle transition, inter-granular fracture, hydrogen embrittlement. Fatigue initiation mechanisms, crack propagation, preventive design. Creep failure, pore formation, grain boundary sliding, high temperature alloys. Testing techniques, fractography.

Prerequisite: Graduate course in Material Science or equivalent. (Winter term).

908. Mechanical Engineering 776. High Strength Materials.

Studies of the microstructures responsible for high strength, and of the thermomechanical treatments producing these micro-structures. Dislocation theory, strain hardening; strengthening by solid-solution, massive hard phases, precipitation, dispersed particles, and martensitic and bainitic structures. Fibres and fibre composites. Residual stresses of thermal or mechanical origin.

Prerequisite: Graduate course in Material Science or equivalent.

908. Mechanical Engineering 779. Electrochemistry for Engineers

An introduction to the thermodynamical and kinematical fundamentals of electrochemistry. The role of electrochemistry in technical processes of corrosion, inhibition and passivity, electrosynthesis, electrowinning and refining of materials, electrochemical energy conversion, water desalination and some applications of electroanalysis.

Fuel cells and the problems of pollution.

908. MECHANICAL ENGINEERING 800. MODERN DEVELOPMENTS IN TRANSPORT PROCESSES

Current topics selected from: heat, mass and momentum transfer.

908. Mechanical Engineering 803.* Modern Developments in Momentum Transfer.

Current topics in momentum transfer.

Prerequisite: A topic in ME700 or equivalent.
(Winter term)

DISSERTATION

901 - Engineering 882. Major Technical Report (2 half-credits)
Registration Sequence: E881 and E882 (First and Second Registration)

901 - Engineering 884. Dissertation (4 half-credits)
Registration Sequence: E881 to E884 (First and Fourth Registration)

901 - Engineering 886. Full Research Thesis (6 half-credits)
Registration Sequence: E881 to E886 (First to Sixth Registration)

The student registers for dissertation work in the same way as he registers for any other half-course in his programme. The appropriate registration sequence and the total number of half-credits for the different dissertation options are shown above.

The Engineering Graduate Studies Committee will determine which of these dissertation options is appropriate in a particular student's programme.

The dissertation, which can vary from a full research thesis to a major technical report, may be based on

one of the following:

(a) A theoretical study of a significant engineering problem.

(b) A research, design and/or development project conducted in the Engineering Laboratories of Sir George Williams University.

(c) A research, design and/or development project conducted as part of the student's full-time employment.

Permission to submit a dissertation in this category will be granted only in the event that:

(i) The student's employer furnishes written approval for the pursuit and reporting of the project;

(ii) The student has research facilities which, in the opinion of the Engineering Graduate Studies Committee, are adequate;

(iii) Arrangements can be made for supervision of the project by a member of the staff of the Faculty of Engineering;

(iv) In appropriate cases, the student has direct supervision by a qualified supervisor at the site of the student's employment. The choice

of supervisor must be approved by the Engineering Graduate Studies Committee.

(d) An ordered and critical exposition of the literature on an appropriate topic in engineering.

The dissertation must represent the results of the student's independent work undertaken after admission to this Programme. Work previously published by the student may be used only as introductory or background subject-matter.

The proposed topic for the dissertation, together with a brief statement outlining the proposed method of treatment, must be approved by the Engineering Graduate Studies Committee.

The dissertation will be evaluated by at least two examiners appointed by the Engineering Graduate Studies Committee.

COURSE LOAD

In general, not more than two courses may be taken concurrently.

The individual programme of study must be completed within five years of the time of initial registration.

FEES

Application Fee (payable by Money Order or Certified Cheque)	$10.00
Fee for each half-course or half-credit	$50.00
TOTAL FEE for course work and Dissertation requirement	$700.00

Other miscellaneous Graduate Fees are listed in the University Announcement.

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